The Use of Tifgreen and Tifdwarf Bermuda Grasses in two Singapore Golf Courses

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Abstract

The two Bermuda grasses were introduced into Singapore in 1981 for use in the Serapong Golf Course of Sentosa and Tanah Merah Golf Course near the Changi Airport. The rooting medium for both courses is sand and the turf was established by sprig sowing.

Tifgreen was used for the fairways and Tifdwarf for the greens. Cultural practices based on recommendations of the consultants to the two golf courses are described. Observed pests and diseases are mentioned. It was the intention of the two Clubs to keep the introduced turf as pure cultures in the courses. Eventually it was decided that only the greens would be maintained as such as it was found too costly to do extensive weeding in Singapore where labour is relatively expensive and the invasion by local grasses and sedges overwhelming. Some of these are briefly described and/or featured in the various photographs.

All in all it is reckoned that because of the ease of propagation and their fast growth, these Bermuda grasses do constitute an easy source of turf to green up a large area within a short time, although initial weeding is essential for proper establishment if sprig sowing is done.

The two Tif grasses have been developed by the Coastal Plain Experiment Station at Tifton, Georgia, U.S.A. The sprigs for turfing up the Serapong Course at Sentosa Island and the course at Tanah Merah Country Club (TMCC) were introduced into Singapore through the Jagorawi Golf Course near Bogor, Indonesia, in February 1981. Together with these two grasses, Santa Ana (another Bermuda variety developed in California) was also brought in. The intention was to use Santa Ana for the tee stations, Tifgreen for fairways and Tifdwarf for the greens. Indeed the two courses were so planted. For the introduction one plastic bagfull (about 0.03 cu m or 1.0 cu ft) of fresh stolons of each hybrid was brought in and these were planted in the Sentosa Development Corporation nursery for further propagation.

The Bermuda grasses belong to the genus called *Cynodon*. According to Beard (1973) they have all originated from East Africa. Repeated interspecific crosses between *Cynodon dactylon*, *C. transvaalensis*, *Cynodon* × *magennisii*, and *C. incompletus* var. *hirsutus* have given rise to many so-called warm season grasses, including Tifgreen and Tifdwarf. Such varieties are used for turfed areas in the warmer regions of the United States. *C. dactylon*, incidentally, is a common grass in Singapore, found in open fields and wasteland. It is a rather coarse grass with a bluish tinge. This texture contrasts very sharply with Tifgreen and Tifdwarf, which are more like the fine varieties of *Zoysia* and *Digitaria*, commonly used for putting greens in this part of the world. Between Tifgreen and Tifdwarf, the latter tends to have shorter internodal lengths and a much higher shoot density, hence its choice for the putting greens. Some stolons and culms of the two Tif Grasses are shown in Plates 1 and 2. Note that both grasses show inflorescences. Indeed, if allowed to grow at long mowing intervals, the two grasses flower freely in Singapore all the year around. It is, however, not known whether they set seeds or if they are sterile.

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Plate 1. Tifgreen Bermuda Grass, stolons, culms, and inflorescence.

Plate 2. Tifdwarf Bermuda Grass, stolons, culms, and inflorescence.

Method of Planting and Turf Establishment

The TMCC course is located on land reclaimed from the sea, using both inland soil fills as well as sand pumped from the sea; while the Serapong course is located both on *in-situ* land and partially on reclaimed land using sea sand as fills. The consultant to the two courses specified that the sprigs be planted in sand for all tees, fairways and greens. It was therefore necessary for a layer of sand to be placed over the finished land form if the material used for the formation of the topography were not sand itself. The thickness of this layer varied between 5.0 and 45 cm or more for the fairways and tees while for the greens 45 and 50 cm was specified. The top 5.0 cm or so of sand was mixed with coco-peat before sowing of the sprigs. By volume the mixture is said to be 80% sand and 20% coco-peat. Sowing was effected by making grooves in the sand and burying the sprigs in the grooves. The depth of the grooves was about 5 cm.

Coco-peat comes from the husk (mesocarp) of the coconut. The husk contains fibres embedded in soft tissue and it is shredded commercially to extract the fibres for making chair and car cushion fillings. In the process, the soft tissue drops out as dust. This particulate material is what the horticulturist calls coco-peat. It does not come from the cocoa plant as some people may think. Neither is it a true peat.

The use of coco-peat to form an admixture with sand serves two purposes: one is to increase moisture retention and the other, after the material has decomposed, is to improve the cation-exchange capacity of the rooting medium. There may well be other organic materials available for use, e.g. sewage sludge, but coco-peat has a great advantage in that unlike sludge it is completely weed-free. As sand is equally or relatively weed-free the sprigs in effect are given a wholesome rooting medium. This accounts for the relative ease with which the turf was established although initial weeding still had to be carried out until the turf covered up the ground completely. This took some 6 to 8 weeks or even longer.

As the rooting medium is sandy it is essential that watering of the newly planted sprigs be done at least once a day during a dry spell. Normally this would not be a problem if sprigging is done after the installation of the irrigation system covering both the greens and the fairways. But if for any reason sprigging has to be done before irrigation installation then to irrigate large areas of planted surfaces could pose a problem even assuming the presence of a water source. Apart from the need to join up long hoses to reach a faraway fairway or green, labour and its supervision may also be a problem. In the case of TMCC there was not much of a problem as the course had irrigation installed progressively before sprigging was proceeded with but the Serapong Course had some problem because as an after-thought, the management committee wanted to convert it from what was supposed to have been a links course to one with more turf and trees. This was achieved only after the addition of many sprinkler heads onto an extended irrigation reticulation.

The sandy rooting medium also meant the need for heavier initial manuring. This had to be done in a state of reduced buffering action because the medium was sand. In such a situation "often but little" is indeed the golden rule for the application of fertilizers. Unfortunately there is in the tropics a complete lack of information in this field. No scientific work has yet been done on manuring in relation to the kind of turf used, the texture of the rooting medium, and the prevailing climatic conditions. Nevertheless, fertilization as depicted in the ensuing section did make the grass grow. The consultant also recommended liming in general. This was found to induce wide-spread iron deficiency, symptomised by general chlorosis in extensive patches of turf. This symptom disappeared only recently some three years after liming was stopped.

Manurial Regime

During the establishment stage the greens, fairways and tees were given a compound fertilizer of composition 1:1:1 in terms of N, P_2O_5 and K_20 the rate being pegged against N and the aim was to give about 0.5 kg of N per 100 m^2 of turf area per month. After the turf was established, the rates were increased, understandably because of the increase in mowing frequency. The table below shows the regime of fertilization, followed at least for some time, after the turf was established and the course opened for play.

	Rate Kg/100m^2	Frequency	Fertiliz. Analysis	Amt/mth N	P_2O_5	K_2O
Greens	3	2 × /mth	16-4-8	0.96	0.24	0.48
F/ways	5	1 × 6 wks	12-12-17	0.40	0.40	0.57
	10	1 × 6 wks	31-0-0	2.07	0.00	0.00
Tees	4	1 × 3 wks	16-4-8	0.85	0.21	0.43

It will be noted that the above manurial regime has an overwhelming amount of N. While this encouraged vegetative growth it also led to undesirable thatching. Combined with a low content of P and K the regime produced a soft grass with shallow roots. As a result when TMCC ran into some problem of water supply during dry spells, the whole course turned brown. Fortunately this problem was solved by pumping water from a not-too-far-away sewage treatment plant to supplement water gathered in several ponds in TMCC. This incidentally also shows that sewage water could be used for irrigating turf, although as used for the TMCC course the sewage water is diluted by surface run off finding its way into the ponds. This has been going on since 1982 and up to the time of writing the course is none the worse. Algae do break out faster during wet spells and when watering is not regulated, due to the ready source of these organisms in the irrigation water enriched by the sewage water.

The manurial treatments shown in the table above also shows some contradictions between rate of manuring and the amount of nutrients removed from the turf. In terms of N, for example, nearly one and a half times more of this element is applied to the fairways than to the greens, this difference despite the fact that the greens are mowed everyday while the fairways are mowed once a week. It is not difficult to see that conceivably much more nutrients are removed from the greens than from the fairways because of the more frequent mowing. Granted that Tifdwarf is a slower growing grass compared with Tifgreen, the discrepancy in fertilizer input is still difficult to justify.

Until a more scientific basis is established for manurial prescription any recommendation currently given is mere guess work. The scientific basis can be arrived at through sampling of turf coming from a known surface area, and analysing for its nutrient contents. Doing this over a fairly long period of time in different parts of the course and under different weather conditions we shall then be able to know how much nutrient is removed through mowing. Our fertilization programme should aim at least at replacing the amount removed.

Invasion of the Courses by Local Grasses and Sedges

When the two courses were constructed, it was the intention of both management committtees to keep tees, fairways and greens pure with the introduced grasses only. However, after the courses were open for play and after some rather expensive rounds of weeding, the idea of purity for the fairways was abandoned. Only the greens and the tees were to be kept pure. At the time of writing, however,

Plate 3. *Brachiara distachya,* one of the early invaders of the Tifgreen in all fairways. See also Plate 8.

Plate 4. *Cyperus kyllingia,* rhizomes and shoots. This soft sedge is another early invader of the Tifgreen. See also Plate 7.

Plate 5. *Cyperus radians*. Multiple shoots from a rosette that has been teased apart. Note the wiry nature of the leaves and inflorescence stalks. See also Plate 6.

Plate 6. *Cyperus radians*, a single rosette/tuft made up of scores of shoots. Its flattened nature makes it easy for the rosette to escape mowing.

practically all the tee stations in TMCC have been invaded and indeed overwhelmed by local grasses and sedges.

One grass and two sedges spearheaded the invasion of the turf and they have become permanent components of the fairways. They are *Brachiara distachya* (Plate 3) *Cyperus kyllingia* (Plate 4) and *C. radians* (Plate 5). *C. radians* is a tufted sedge with wiry leaves and inflorescence stalks (see Plate 6) whereas *C. kyllingia* is a much softer sedge (see Plate 7). Indeed if mowing can keep this sedge short and prevent it from producing its small round inflorescence, then it can be accepted as a fairly good turf. In fact both courses have extensive patches of this sedge. *Cyperus radians* on the other hand forms individual tufts, usually in the moister parts of the fairways and a large patch of the tufts could present a rather ugly picture because of its coarseness. Mowing would not improve its appearance as the tuft tends to flatten out into a rosette, adpressed to the ground (see Plate 6). The cutting blades of the mowing machine could not touch the wiry strands.

Brachiara distachya is a soft grass with an elliptic leaf blade (see Plates 3 & 8). The untrained eye may mistake it for the ordinary so-called Cow Grass *(Axonopus compressus)* but *B. distachya* is dull green contrasting with the brighter green of *Axonopus compressus,* which also has a glossy surface (cf. Plate 9). Like *Axonopus, Brachiara* creeps horizontally with the culms adpressed to the ground. Leaf blades which have been partially cut by mowing show a necrotic cut edge and this can be seen easily on the course.

Brachiara starts as a small nucleus well concealed by the Tifgreen. By the time it is noticed, the grass would have several rooted culms. This should be the time to have it weeded out by uprooting. But one just could not cope with literally thousands of such proliferating nuclei all over the course. This grass is so successful that it is estimated to cover some 30% of the fairway areas, forming large pure patches to the complete exclusion of any other grass.

Apart from the three plants mentioned above one can also find other so-called weeds invading the Tifgreen both in the fairways and in the roughs. Amongst the common ones are *Axonopus compressus* (Cow Grass), *Digitaria setigera* (Syn. *D. marginata*), *Digitaria didactyla* (Serangoon Grass), *Eleusine indica, Ischaemum* spp., *Panicum* spp. and *Eragrostis* spp. A couple of herbaceous weeds also appear here and there. They are *Borreria setidens,* the clover *Desmodium trifolium, Euphorbia hirta* and *E. thymifolia.* The latter *Euphorbia* caused quite a bit of problem in the Serapong Course in Sentosa because in some fairways and aprons its proliferation was rampant. (Some of these plants are shown in Plates 10 to 14 inclusive.)

So far we have not mentioned anything about control of the weeds or the unwanted plants by using weedicides. During the course of the past few years someone did suggest that but in so far as *Brachiara distachya* and *Cyperus kyllingia* are concerned they are far too numerous and all too pervading to allow chemical control. To spot spray these when they formed small nuclei would be like looking for needles in haystacks and if we start spraying the larger visible patches, then we are going to create a patchwork of dead turf all over the course.

Someone also suggested using pre-emergent weedicides to treat an area before it is turfed. This may well be successful from the start but it is doubtful if we could keep the turf pure subsequently without continual weeding. Moreover, the pre-emergent weedicides are known to be fairly expensive. To treat the whole course before turfing is to incur a big extra cost.

Pests and Diseases

For the fairways little attention is paid to these two aspects of maintenance work but for the greens there is a constant watch-out for outbreaks of pests and or

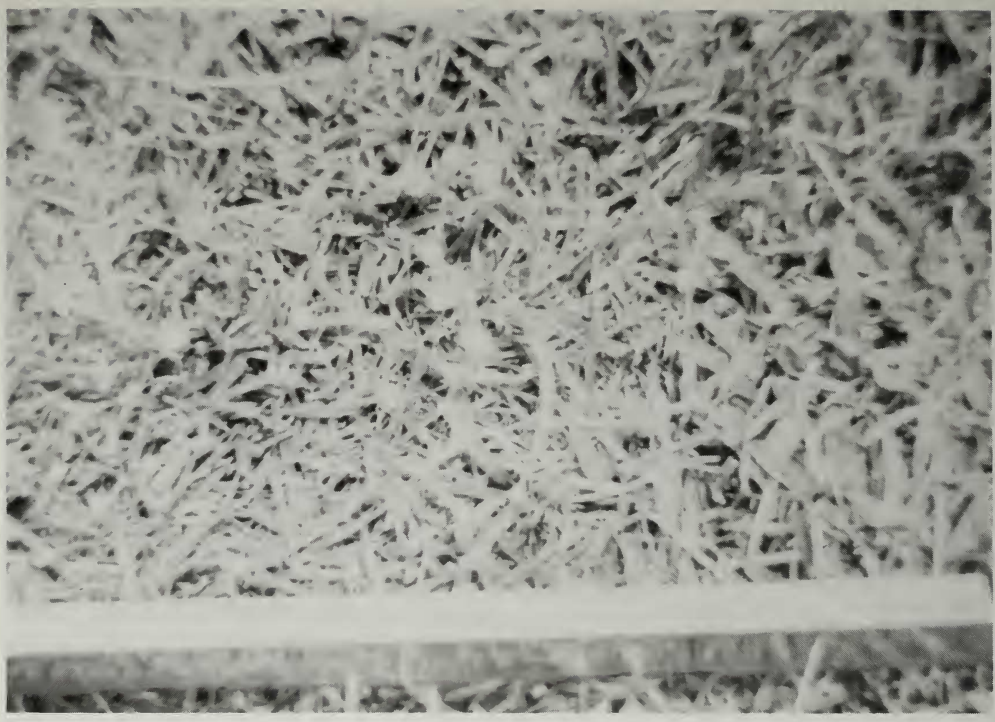

Plate 7. *Cyperus kyllingia* flowering in the rough. Compared with *C. radians* this is a much softer sedge.

Plate 8. *Brachiara distachya* about to finish off the Tifgreen in a patch of turf. *B. distachya* has broad elliptic leaves. Close scrutiny will reveal the fine Tifgreen.

Plate 9. *Axonopus compressus*, the so-called Cow Grass.

Plate 10. A close-up view of stolons and culms of *Digitaria didactyla*.

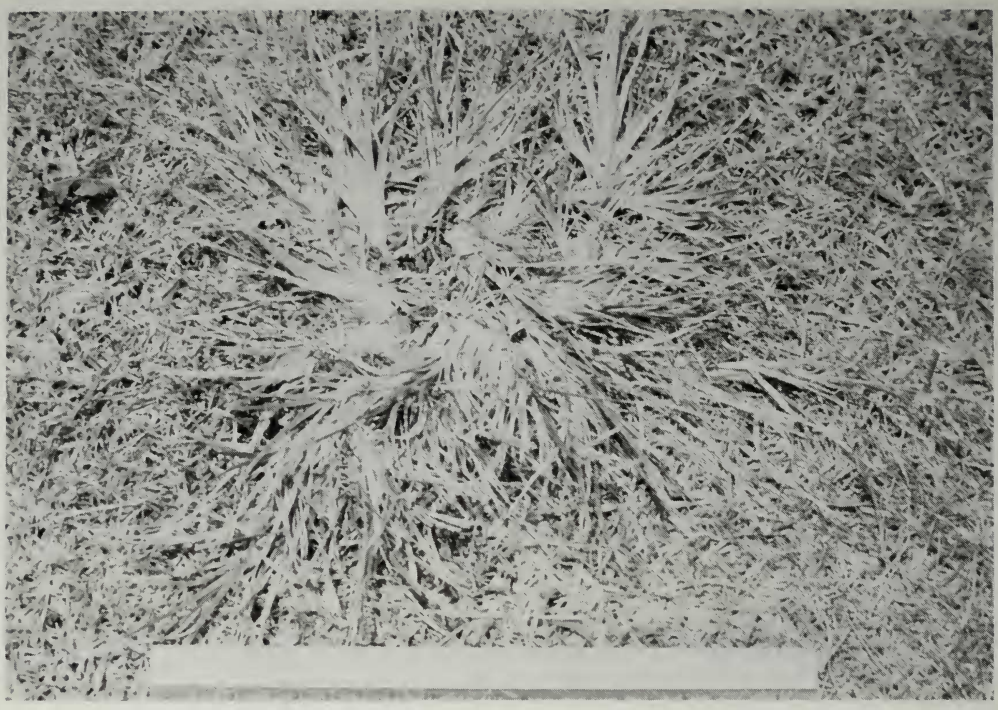

Plate 11. A compact group of the obnoxious weed *Eleusine indica*. Mowing has flattened the culms but could not get rid of them.

Plate 12. *Digitaria marginata*, invading Tifgreen in the rough.

Plate 13. *Euphorbia hirta (left)* and *E. thymifolia (right)*. These are two common herbaceous weeds invading fairways and aprons.

Plate 14. *Borreria setidens*, a herbaceous weed invading Tifgreen in the rough.

diseases. Tifdwarf, however, seems to have encountered relatively few problems in this respect. The only ones seem to be the occasional fungal attack, resulting in dying back patches here and there in the green, or rarely an outbreak of cutworms may send the green keeper rushing for his sprayers. Such events, however, are no more than what other varieties of turf used for the green would experience.

During one of the fungal outbreaks at TMCC some 4 years ago, the Primary Production Department plant pathologist was called in to track down the identity of the fungus or fungi. It was discovered that the malady responsible seemed to be a *Curvularia*.

When there is an outbreak of pests such as cutworms, the caterpillars of one of the Noctuid Moths, drenching the affected green with Sevin, a carbamate, is effective. After the worms are got rid of, a few more weekly rounds of prophylactic spraying will put the green back to normal. In the case of fungal outbreak the common practice is to use the fungicide Benlate. Spraying is done weekly until symptoms disappear. This could be followed by a short period of prophylactic treatment, perhaps at a longer spraying interval, say once in two weeks.

Conclusion

Based on the experience in Singapore it would appear that the two Tif grasses did constitute an easy source of grass to turf up a large expanse of land. They proliferate fast so that a relatively small nursery area is sufficient to propagate the initial amount for planting up an area of fairway or green. Thereafter the planted materials become further sources of the grasses. Indeed it has been found that the growth is in exponential fashion. It is said that an area of planted material will be ready for harvesting in about 8 to 10 weeks, this area providing enough planting material for an area 20 times its original size. This has been found to be true.

It is reckoned that it would be futile to try to keep the fairways pure. This is difficult even if management is prepared to spend money to have manual weeding carried out. Neither would it be practicable to carry out chemical control. The best thing to do is to let plant succession take place, after the Tifgreen has properly established itself, under constant mowing, which in itself is an effective way of keeping out most of the coarse and upright grasses. For the really obnoxious ones, viz. *Cyperus radians* and *Eleusine indica,* which fortunately occur in isolated or distinct units, manual digging continually may be the answer to keep them under control. The resultant turf, such as is seen emerging in Serapong and TMCC, is perfectly acceptable as playing surfaces.

References

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